

**XILINX FPGA DESIGN FOR AC-TO-AC SINGLE PHASE MATRIX CONVERTER
WITH SINUSOIDAL PULSE WIDTH MODULATION**

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MOHAMAD ADHA BIN MOHAMAD IDIN

**Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR**

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Mohamad Adha bin Mohamad Idin
Faculty of Electrical Engineering
Universiti Teknologi MARA.

ABSTRACT

The project is concerned on development of xilinx FPGA design for AC-AC single-phase matrix converter (SPMC) modulated using the widely known sinusoidal pulse width modulation (SPWM). The single-phase matrix converter (SPMC) uses 2 IGBT and 2 diode as switches to form bi-directional four-quadrant switching.

Using an IGBT modules assemble the basic power switch. A converter is constructed and fed from 50V(rms), 50 Hz, supplying a passive R and RL load operated at multiple frequency of 50Hz. The model of Single Phase Matrix Converter (SPMC) is designed using computer simulation models using the Power System Block Set (PSB) within MATLAB/Simulink (MLS) environment, which has been developed. The SPMC as a direct frequency changer is used in this work with the output being synthesized using the well-known Sinusoidal Phase Width Modulation (SPWM). One sine waveform with one carrier waveform is used to generate Pulse Width Modulation (PWM). The simulation result will get by using Matlab/Simulink simulation and also by using PSPICE. Xilinx is use to control the switching pattern of SPWM.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The AC-AC matrix topology was first reported by Gyugyi[1] in 1976 in a conceptual manner; very theoretical in nature but useful for providing insights for foundation of future research. In its basic form the matrix converter is a special class of Cycloconverter that was developed in the early 1930s. This was later used by Alesina *et al*[2] to develop a generalized high-frequency switching strategy providing several attractive features and described as a generalized transformer synthesis. These if could be realized in practice are a powerful solution of making an all silicon solution system. Earlier works of matrix converter (MC) is based on output synthesized from three-phase input denoted by TPMC. Single-phase matrix converter denoted as SPMC was first realised by Zuckerberger *et al* [3].

In this work a direct AC-AC converter were presented to operate as a direct frequency converter with simulations presented using MATLAB/Simulink and Pspice. For this project, FPGA(xilinx) will used as a controller to control the SPWM switching pattern. Other SPMC topology had been studied by Hossieni *et al* [4] in an attempt to generalize its mathematical model. Amongst applications that has been seen to provide potential in matrix converter applications includes the control of induction motor drives as evident in the work of Ribickis *et al*[5].

Detailed mathematical treatments afforded in those earlier works makes matrix converter a difficult subject to study and thus limiting the number of experts on the subject matter. This project carried out in developing computer simulation models using the Power System Block (PSB) within the MATLAB/Simulink (MLS) environment. Its powerful filter design tools, signal processing capabilities are used to illustrate the convenience of modeling and simulation. Basic results are compared with simulations carried out in Pspice to ascertain its validity. The SPMC as a direct frequency changer in